Assessing the Effectiveness of Virtual Reality Technology as part of an Authentic Learning Environment

Ros A. Yahaya
Queensland University of Technology
r.yahaya@qut.edu.au

Abstract

Application of Virtual Reality (VR) in training and education seems to give excellent promise in providing an alternative "real life" environment in situations where it is impossible for students to experience. However, there has been limited research investigating the effectiveness of immersive VR technology as part of an authentic learning environment. This study attempts to create an authentic learning environment by incorporating immersive VR technology as part of the delivery mode, conducted at a large technology-based university in Australia. The aim is to engage learners through the use of a simulated organization that involves real world problems. Learners are exposed to decision making theories from the beginning of the semester which culminates with immersive VR environment where they experienced real life crisis. The findings report that immersive VR environment helped increase students' understanding of decision making

1. Introduction

Technology offers great advantages for authentic learning environments that were not available before. Technology can provide scaffolds for the students, and can allow students access to tools not normally encountered in schools. Students on the other hand, are becoming more and more technology literate. Dealing with today's generation of students who are exposed to the latest technological advancement is no longer the same as it used to be. Change in the learning environment must occur when it comes to teaching these students. Traditional learning environments are no longer able to effectively accommodate their high expectations. Thus this study attempts to incorporate VR technology in order to create an authentic learning environment with the purpose of increasing students' learning.

Immersive VR technology is increasingly being recognized as having excellent potential in education [3]. However few studies have been carried out to support this idea. Thus this paper attempts to find out the effectiveness of VR as part of an authentic learning environment, in enhancing learning in Marketing Decision Making. Five different modes of delivery were explored, where immersive VR technology is the main focus. Other modes include lectures and tutorials, group work, online learning and industry panel presentation. By way of background research, two issues will be explored, namely authentic learning environments and immersive VR environments. These issues provide a framework for exploring the implementation of an authentic learning in Marketing Decision Making.

2. VR and authentic learning environments

Authentic learning environment is a pedagogical approach that allows learners to explore, discover and discuss ideas to come up with meaningful information. Learning in such environment enable learners to construct concepts and relationships in contexts that involve real world problems and projects that are relevant to the learners and relate to their real life experience [4, 5, 8]. These meaningful contexts are key to promoting the acquisition and application of skills based on real life situations, problems and tasks.

Immersing students in an authentic setting has the capability to motivate and encourage learner participation through students' willing suspension of disbelief. In this way, students become immersed in the setting and such immersion can provide the motivation that is needed for the initial perseverance [9]. Once students have persevered with what can initially be quite discomforting and unfamiliar settings, they are able to develop the forms of familiarity and

Proceedings of the Sixth International Conference on Advanced Learning Technologies (ICALT'06)
0-7695-2632-2/06 $20.00 © 2006 IEEE

the skill sets required so that the authentic setting no longer provides a distraction from the cognitive engagement that higher order learning requires [11]. Different competencies developed through authentic learning environment that represents real life problems are vital in ensuring learning that lasts. VR technology has the potential to provide real world simulations with real world complexity and limitations that are present in real life [3, 11]. Given situations or circumstances where exploration of real environments is impractical, dangerous or inaccessible VR technology provides an alternative experience. Honnebein et al. (1993) argue that students learning in such environments should be able to demonstrate the knowledge learned to face their future professional life.

Previous studies utilizing VR simulation of the real world has shown to be equally as effective as real life [3], enhance the learning achievement levels of students [2], enhance the problem solving skills of students [6] and foster peer interaction [1]. Positive educational impact resulting from VR environment would be invaluable in the training of undergraduates from many areas. Youngblut (1997) suggested that future research in VR should focus in the areas such as how VR technology should be integrated with other educational activities [10].

3. Context

This study is a semester long study where students were observed in the classroom setting and in the VR theatre setting. The lectures and tutorials were taught by the same lecturer. However, another lecturer acted as a facilitator for the VR simulation exposure. Participants of this study were a cohort of 18 final year students studying an undergraduate degree in Business. The subject studied was Marketing Decision Making. For the VR aspect of the authentic learning environment, a simulated organization called Virtual Golden Foods Corporation (VGFC) was developed using Virtual Reality Modelling Language (VRML). It represents a large corporation involved in food processing and manufacturing, with several different departments including Accounts, Finance, Advertising, Marketing and Public Relations, Production and Services and Human Resource. For the purpose of this study, the focus was on the Marketing arm of the corporation. At the end of the semester, students were brought to a large VR theatre and were exposed to the simulation. The simulation consists of several critical incidents embedded in the day-to-day running of a food canning factory. A facilitator was involved in running the VR simulation. Vital company statistics based on the critical incidents were given on the screen. As marketers, students were asked to make decisions based on the given scenario. Students were expected to apply knowledge gained throughout the semester in the VR scenario.

Data sources included focus groups, classroom and VR theatre observations and interviews. Two focus group sessions involving all students were held at the end of the semester after exposure to the VR simulation. The researcher was present in all lectures and tutorials, in the VR intervention and during the industry presentation. All observations and discussions were either video-taped or voice recorded and transcribed. Classroom interactions between group members and with the lecturer were coded. Informal, short interviews were conducted from time to time to interpret students' interactions. During the VR simulation, three video cameras were placed strategically in the theatre to capture student interactions with each other and with the facilitator.

4. Delivery mode

Several modes of delivery considered suitable for the subject were selected and outlined in Table 1 below:

Table 1. Delivery Mode

Delivery Mode	Nature	Time delivered
Lectures and tutorials	3 hours per week	Throughout the semester
Group Work	Groups of 4/5 working on their project	Throughout the semester
Online learning	Online forum, notice board, email	Throughout the semester
VR intervention	Simulation presented in a VR theatre	End of semester
Industry panel presentation	Group presentation of projects	End of semester

These different modes of delivery run throughout the semester with the VR intervention held at the end of the semester, before the industry panel presentation.

5. Outcome and discussions

The outcome of this study provides an insight to how students responded to an authentic learning

environment incorporating immersive VR technology with lectures and tutorials, group work, online learning, and industry panel presentation. The study in particular revealed a number of key issues including student involvement in the case study, students' understanding of the theories and concepts and the support of online learning in increasing understanding.

Generally students were more informed of the case study scenario after the immersive VR exposure. Many of them felt the learning experience helped them to be involved in the case problem. However, the VR environment was conducted by a different lecturer, which made students felt that they had to adjust to him before they can concentrate on the tasks at hand. Feedback from the industry panel indicated that students had an excellent grasp in applying the different decision making models to their case study. The VR intervention actually helped them realized that things could go out of hand and could adversely affect normal day-to-day operations. The online learning played an important part in supporting student learning. Every aspect of the online learning portal provided by the university was utilized to deliver information to students. Discussion forums allowed students to apply their knowledge learned in class and gave feedback, discussed or critiqued each other's responses.

Results of this study also support the idea that using VR technology as part of an authentic learning environment is an effective method of delivering knowledge in the classroom. The integration of VR technology not only enhances learning, but it also provides participants with real life experience that they can relate to. While it remains to prove conclusively that learning is significantly enhanced in this setting, the positive reactions of students provides, at a minimum, a platform to continue to explore the potential of VR. It is recommended that future research focus on delivering high quality graphics in a VR simulation to match students' expectations. Advances in technology will make it cheaper and easier to provide such environment in the university setting. Researchers are also urged to expand the application of VR into other areas of study.

**The author wishes to acknowledge P. Jackson and T. Euler for their contributions to the research.*

6. References

[1] Andolsek, D. L. (1995). "Virtual reality in education and training." *International Journal of Instructional Media,* 22(2), 145-155.

[2] Bowman, D. A., Hodges, L. F., Allison, D., & Wineman, J. (1999). "The educational value of an information-rich virtual environment." *Presence: Teleoperators and Virtual Environments,* 8(3), 317-331.

[3] Bricken, M., & Byrne, C. (1992). "Summer students in virtual reality: A pilot study on educational applications of VR technology." Seattle: University of Washington, Human Interface Technology Laboratory.

[4] Brown, J. S., Collins, A., & Duguid, P. (1989). "Situated cognition and the culture of learning." *Educational Researcher,* 18, 32-42.

[5] Donovan, M. S., Bransford, J. D., & Pellegrino, J. W. (Eds.). (1999). "How people learn: Bridging research and practice." Washington, DC: National Academy Press.

[6] Gokhale, A. (1996). "Effectiveness of computer simulation for enhancing higher order thinking." *Journal of Industrial Teacher Education,* 33(4), 36-46.

[7] Herrington, J., & Oliver, R. (2000). "An instructional design framework for authentic learning environments." *Educational Technology Research and Development,* 48(3), 23-48.

[8] Honebein, P.C., Duffy, T.M., & Fishman, B.J. (1993). "Constructivism and the design of learning environments: Context and authentic activities for learning." In T.M. Duffy, J. Lowyck, & D. Jonassen (Eds.), *Designing environments for constructivist learning* (pp. 87-102). Berlin: Springer-Verlag.

[9] Yahaya, R. A., Euler, T., Godat, M. (2004). "Enhancement of Learning in Decision Making and Negotiation within Virtual Reality Environment." In Erica McWilliam, Susan Danby and John Knight (Eds.) Performing Educational Research: Theories, Methods and Practices. Postpressed Flaxton, QLD, Australia.

[10] Youngblut, C. (1997). "Educational uses of virtual reality technology." *VR in the Schools,* (3) 1.